

SIEMENS

Ingenuity for life

Automotive and transportation

Team Penske

New digital innovation platform propels Team Penske to championship season

Products

NX, Teamcenter

Business challenges

Transition to new engineering solutions without hampering productivity

Leverage advanced engineering technologies to win more races

Comply with new regulations, rule changes and develop a new race car

Keys to success

Extensive planning for system migration, user training and adoption

Intensive support from Siemens

Creating digital twins of race cars

Fast adoption of new engineering tools and technologies

Results

Completed the best racing season in team history

Delivered parts to the track in less time

Achieved 32 wins, 35 poles, two series championships

Achieved 200th IndyCar win and 500th team win

Team Penske leverages the digital twin to make race cars run faster

Engineering to win

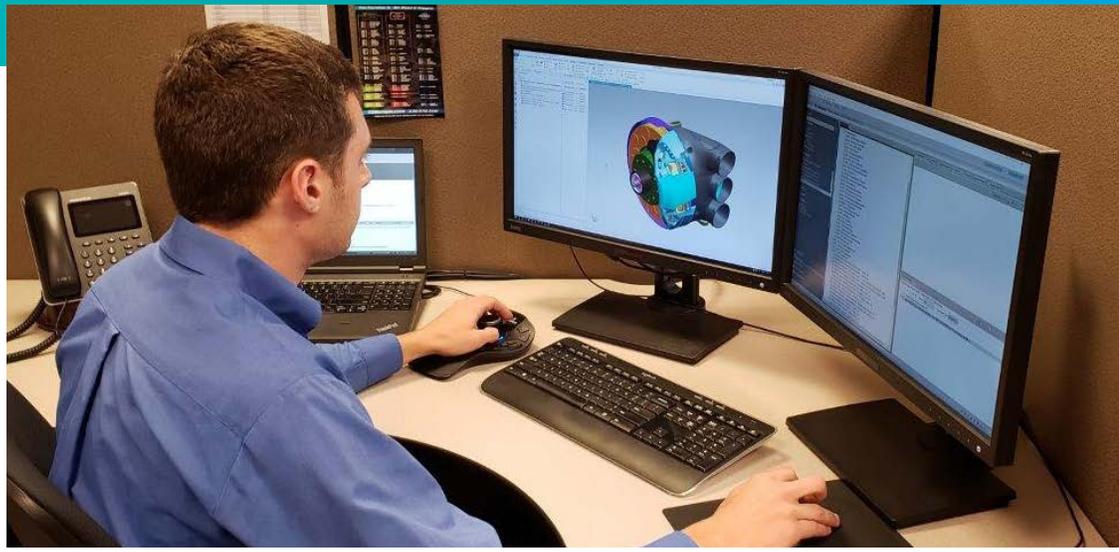
Team Penske entered the 2018 racing season as one of the world's most successful motorsports teams, and completed the best season in its history. The organization collectively produced 32 wins, 35 poles, two series championships, its 17th Indianapolis 500 victory and the 500th all-time win in team history. All three of the team's Monster Energy NASCAR Cup Series (MENCs) drivers earned spots in the playoffs and they each recorded playoff wins. Brad Keselowski went on a historical three-race winning streak in September, recording the

team's first Southern 500 victory at Darlington since 1975, then posted Team Penske's first-ever Brickyard 400 win at the Indianapolis Motor Speedway, completing the remarkable run by winning the playoff opener at Las Vegas for Team Penske's 500th all-time victory.

Changing horses in midstream

Team Penske's championship season coincided with the racing team's adoption of a new engineering platform that included software for computer-aided design, engineering and manufacturing (CAD/CAE/CAM) and product lifecycle management (PLM). As the team's contract with its previous solution provider approached its end in 2017, Team Penske began investigating alternatives and evaluating new technologies that could enhance its performance in the





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fast-paced and demanding world of race car development. The engineering teams were in favor of Siemens Digital Industries Software’s platform and CAD system because of its extensive use and proven reputation in automotive development. Team Penske started the conversation with Siemens, which continued to a proof of concept, then accelerated to a faster pace.

Especially for engineering-driven companies like Team Penske, a change of the software that underpins the all-R&D, all-the-time activity could be risky. As the affected personnel and processes transition to new systems, productivity can suffer. Team Penske had used its previous engineering software for two decades.

“We were changing to another system, not just the CAD, but also the PLM,” says Mark Stewart, director of information technology at Team Penske. “We were also changing over the machine shop – all of the machining and the postprocessing. Processes had to change. How could we be sure we were making the right decision? Everyone had to be educated quickly enough to grasp this and actually be successful.”

Stewart and the engineering teams made meticulous plans for the transition, minimizing the risk through every detail, including the migration of legacy engineering data, the system architecture, end-user training, support and implementation to make the transition as seamless as possible. “We

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wanted to use the system 'out of the box' as much as we possibly could," Stewart says. "Because each new version of the software includes new competition tools, we wanted to stay on the latest release of the software for our competition and innovation needs."

After a flawless weekend cutover to the new tools, Team Penske focused in the first year on a "like-to-like" replacement strategy. For PLM and CAD/CAE/CAM, the teams were using proven workflows and processes on their prior platform that could be readily applied in Siemens' Teamcenter® and NX™ software. "For year one, I couldn't have dreamed how simple it was to make a big change like this, or that it happened as well as it did," Stewart says. "Our R&D team was able to embrace this technology and make it a winning tool."

A winning tool for R&D

Motorsports regulations maintain strict constraints on what can be engineered into a race car. "It's a restrictive environment where small changes and attention to detail matter more," says Drew Kessler, design engineering manager for the NASCAR teams at Team Penske. "We call it stacking pennies to make dollars – so we improve a hundred things that are not measurable by themselves and put them all together to get a good chunk of performance. The details count."

Regulations work differently for the IndyCar team. "IndyCar is a spec series, so we don't produce a lot of parts in-house," explains Brian Campe, engineering coordinator for the IndyCar and sportscar teams. "We purchase the outside parts of the car and the chassis, and the engines are leased from Chevrolet. Our engineering is more of a continuous quality control exercise, taking purchased parts and improving upon them where allowed."

Improving performance with the digital twin

For Team Penske's NASCAR race teams, most of the performance improvements are realized through aerodynamic engineering. Sixty percent of the engineers on the team are dedicated to aerodynamics, and were trained in the use of the leading-edge surface design tools and techniques of NX. The Siemens toolset played a strong role in a project that began early in 2018 and delivered results on the track later in the season.

"The target was to improve front-brake cooling," Kessler says. "We always run the brakes on the car as hot as we can without having a failure – that's upward of 1,000 degrees on the discs and 300 to 400 degrees on the calipers. If we could make the ducts cool the brakes more efficiently, we could use more air to make the car go faster. Our goal was to improve the efficiency of the system by 10 to 15 percent."

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NASCAR Teams
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For this project, the team used a digital twin methodology – building virtual models and using simulation technologies to deliver results to the track more quickly. This is an approach that the Siemens solution specifically supports.

First, aerodynamics and design engineers used the surface modeling tools of NX to model a new set of ducts. The virtual model was immediately available to all members of the development and production teams via the Teamcenter interconnection between the departments. “We had the consumers of the data and the production folks in the loop early on,” says Kessler. “The composites shop reviewed the tooling and the construction as the design was developing, which definitely saved some headaches later.”

The team used the design model directly in computational fluid dynamics (CFD) simulations to virtually validate the air flow. “The surfacing tools and synchronous modeling of NX, where you can simply push and pull to tweak the geometry, allow us to make CFD iterations quickly and painlessly, really improving the efficiency of the design process,” Kessler says.

Confidence in the digital twin

In addition to CFD, the duct system development also relied on wind tunnel and other physical testing. “We made physical prototypes in metal and plastic and tested them on both a test rig and in the wind tunnel,” says Kessler. “The results of the physical testing correlated to those of the CFD simulation, giving the team high confidence in the digital twin. Before this project I didn’t have a lot of confidence in developing things in the virtual world. I do now, as a result of this project.”

For Team Penske, the only tests that matter, always, are on the race track. “That’s the only time we see the race duty cycle with the race wear and race conditions,” Kessler explains. “Everything’s hot – it just doesn’t exist anywhere else outside the racetrack. We took a leap of faith and put the new ducts on a low-risk car and raced it at



Charlotte. Through passive data acquisition, we found that we hit closer to 25 to 30 percent: we were able to reduce rotor temperature by 200 degrees and calipers by 80 to 100 degrees. We have moved it into production with all our cars.”

Transforming manufacturing

Manufacturing at Team Penske has also found efficiency gains using the new innovation platform. “As soon as engineering releases a new design, we access the new CAD model and documentation through Teamcenter, create the manufacturing assembly and start programming the part,” says Jim O’Toole, machine shop manager at Team Penske. “If it’s a part with minor revisions, we can take the current NC programming file, load that revision and regenerate the toolpath, using the associativity aspects of Teamcenter and NX. It makes it seamless to recreate the toolpath and generate machine code – for general 3-axis machined parts it saves four to six hours of the typical eight hours of programming time.”

O’Toole admits to some apprehension at the start of the new season with a new engineering platform.

“When we were notified that we would be transitioning to a new system, it was our busiest time of the year, preparing for the next season,” O’Toole recalls. “I was nervous and somewhat fearful for how that would pan out. To be able to integrate something that our programmers had never seen

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Jim O’Toole
Machine Shop Manager
Team Penske

Solutions/services

NX
siemens.com/nx
Teamcenter
siemens.com/teamcenter

Customer's primary business

Team Penske is one of the most successful teams in the history of professional sports. Competing in a variety of disciplines, cars owned and prepared by Team Penske have produced more than 500 major race wins, 450 poles and 29 national championships.
www.teampenske.com

Customer location

Mooresville, North Carolina
United States

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before, and to expect them to have similar speed and accuracy that they had with the old software was a big challenge. Of course we had hiccups along the way, but as we developed better skill sets, we could see the value."

Among the NX capabilities for manufacturing that have improved efficiency at Team Penske, O'Toole cites many that enable cleaner, more efficient and faster programming, including improved toolpath editing, operation types such as fixed- and variable-axis guiding curves, machine templates that automatically apply all the parameters in machining operations, and foolproof, one-button-click creation of accurate shop documentation. "That has saved us hours on end and replaced a manual-intensive and error-prone process, and we save at least two hours on each part we program," O'Toole says.

Expert service and support from Siemens

All of the people affected by the new Siemens engineering platform are sighing relief and looking optimistically to the new season. One of the key factors agreed on by all is the pivotal role of Siemens' support and services throughout the planning, implementation and adoption of the new

system. "There's great support out there," O'Toole says, referring specifically to the Siemens Global Technical Access Center (GTAC). "We have relied on GTAC for both programming and postprocessing support. We never feel like we're out in the cold alone."

Stewart echoes the sentiment. "If there's any question whether we made the right decision, we can look at the guidance we get from the Siemens services team, the project manager, the people supporting us here. There's definitely some true skill and experience with the Siemens organization. We were working with people with decades of experience. I was definitely comforted to know that's the quality of the support we have."

The only results that matter

"From a performance perspective we were able to hit the ground running with the new system, improve our speed and get parts to the track faster," says Kessler. "The biggest metric we have and our singular focus, even if you talk to our president or Roger Penske himself, is the results on the track. This year we had the Indy 500 win, race wins in IMSA, the 200th Indy car win, the 500th total win, the Monster Cup championship. That's the bottom line."

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Team Penske

Siemens Digital Industries Software

Americas +1 314 264 8499
Europe +44 (0) 1276 413200
Asia-Pacific +852 2230 3333

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